

# **ACOUSTIC INSTRUMENTATION FOR THE OBSERVATION OF BIOMASS AND SIZE-STRUCTURE OF ZOOPLANKTON AND THEIR TEMPORAL VARIABILITY**

Sharon L. Smith and Harry A. DeFerrari  
Rosenstiel School of Marine and Atmospheric Science  
University of Miami  
4600 Rickenbacker Causeway  
Miami, Florida 33149  
Telephone: 305-361-4819  
Fax: 305-361-4765  
Email: ssmith@rsmas.miami.edu

Award # NOOO149710347

## **LONG TERM GOALS**

Many of the highly productive ecosystems of the world ocean are strongly forced physically and exhibit maxima in biomass and growth of zooplankton during bursts of phytoplankton growth. The role of the physical environment in shaping the community of zooplankton is difficult to study and can best be addressed in interdisciplinary studies using new instrumentation for quantifying biological response variables. Improved resolution of temporal and spatial variability of biomass of zooplankton and the physical environment are necessary steps before we obtain full understanding of mesoscale ecosystem questions.

## **OBJECTIVES**

It is essential to continue improving the acoustic technology for observing zooplankton because its power is in the extended (in time primarily) and intensive (in space primarily) nature of the data it generates. We need both the capability for making long-term observations of plankton on continental shelves and for obtaining the data in real-time. We anticipate an instrument or set of instruments that are deployed over the continental shelf off Florida which broadcast their data daily allowing us to make additional measurements of important processes such as grazing and growth in a select and focused way.

Major advances in acoustical measurements have come about by applications of pulse compression techniques to problems of low frequency acoustics. Tomographic studies now underway routinely detect signals at ranges of up to 5000 kilometers. Without phase coherent processing and pulse compression, ranges would be reduced to about 50 kilometers. We believe that similar orders of magnitude improvements in the range of acoustic remote sensing instrumentation will come about by the application of pulse compression techniques to the high frequency problems. In theory, a new pulse compression scheme in use at the University of Miami has no side lobes and should

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>30 SEP 1997</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-1997 to 00-00-1997</b>	
4. TITLE AND SUBTITLE <b>Acoustic Instrumentation for the Observation of Biomass and Size-structure of Zooplankton and Their Temporal Variability</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>University of Miami,Rosensteil School of Marine and Atmospheric Science,4600 Rickenbacker Causeway,Miami,FL,33149</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>3</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

increase the range in operation of a typical ADCP by a factor of 100. The critical factor in realizing this improvement in performance is knowledge about the randomizing effect of propagation through the real ocean. Such information can only be obtained by measurements at sea. This work is supported by ONR Biological Oceanography.

## **APPROACH**

The development will be a two step process. In the first step, we will obtain the instruments, deploy a mooring, and develop the capability for collecting and analyzing real-time data. In the second step, we will use the real-time information to study processes of zooplankton, zooplankton biomass variations, and zooplankton community size-structure over the Florida continental shelf.

## **WORK COMPLETED**

The instrumentation funded in this DURIP award have been ordered. We expect delivery before the end of November.

## **RESULTS**

We do not have any results yet.

## **IMPACT**

The proposed instrumentation will provide the basic ocean measurement suite to test signal processing concepts at sea. If successful, the method will have application to the problem of mine countermeasures and many other types of acoustic measurements in the ocean. If we are successful in improving both the multifrequency and acoustic Doppler current profilers for the measurement of zooplankton biomass in the sea, they should become widely used in all types of ecological investigations. The need for sensors which can be moored or used routinely on a CTD is great.

## **TRANSITIONS**

Following our initial use of the acoustic Doppler current profiler to estimate biomass of zooplankton in the Middle Atlantic Bight (Flagg and Smith, 1989), the instrument has been used by us in several other projects and by others in various regions including Antarctica. We have gained substantial understanding of zooplankton variability on the mesoscale from all these various efforts, understanding that would never have been possible with net tows.

## **RELATED PROJECTS**

At the present time, NOAA is funding interdisciplinary investigations of Florida Bay and several agencies including NOAA and EPA are involved in restoration of the marine environment of south Florida. Earlier studies, the Southeast Fisheries and Caribbean Recruitment project (SEFCAR), have found that the small eddies which are associated with the Florida Current and coastal current off the Florida Keys are an important factor in the movement of larval fish over the coral reefs. Moored sensors such as we expect to perfect with this DURIP equipment would contribute significantly to investigations of coastal ecosystems.

## **REFERENCES**

Flagg, C.N. and S.L. Smith. 1989. On the use of the acoustic Doppler current profiler to measure zooplankton abundance. *Deep-Sea Research*, 36, 455-474.